

Area of impact: Science and the environment

5. (a) **Identify *two* input devices that are required in order for Jules to interact with a real person.** **[2 marks]**

Answers may include:

- microphone
- digital video camera or web cam
- camera.

Award [1 mark] for each input device up to a maximum of [2 marks].

- (b) **Describe the steps that Jules would take in order to follow the movement of the person talking to him.** **[4 marks]**

Answers may include:

- capture the initial image of the person with the web cam/robot (sensors) captures image
- use facial recognition software to determine the parts of the face to be tracked (reference points) / identify parts of the face (eg eyes for eye contact)
- record an initial position (*i.e.* t_0), of the face to be tracked/set the position of the human in relation to robot's own position
- record time lapse intervals
- capture another image at a second position (*i.e.* t_1)
- determine the location of the reference points
- compare new position of reference points (t_1), with the initial position (t_0)
- if position is the same as before, then no movement is detected and there is no adjustment
- if position changes, movement is detected and robot adjusts to the movement
- changing voice frequency may assist in determining the person's position
- calculate the rotation to move Jules' head
- actuators/mechanical devices rotate robot's head the required distance
- loop/repeat the process.

Ref: http://mail.isr.uc.pt/~mrl/admin/upload/Paper_EPIA07-LNCS.pdf

Award [1 mark] for each step up to a maximum of [4 marks].

- (d) **Jules may have difficulty understanding a sentence in a conversation with a human. Explain why this could happen.** **[4 marks]**

Answers may include:

- vocabulary used in the sentence is unknown to the robot (reason: word is not in its internal language database)
- unusual grammar or sentence structure (reason: may be limited by Jules' ability to eg analyse context)
- accent or dialect making the words sound different (reason: robot has not been trained to recognise that person's voice)
- idiomatic expression was used
- Unclear/inaudible speech (reason: captured voice unclear then converted to digital sound files which can't be matched)
- Background noise/interference may mask human voice input
- linguistic differences - words may have different meaning depending of the context.

[1 mark]

A limited response that indicates very little understanding of the topic or the reason is not clear.

[2–3 marks]

A reasonable description of the difficulties that Jules has in understanding a sentence in a conversation with a human. The answer may be unbalanced and lack appropriate reasoning at the lower end of the band.

[4 marks]

A clear, detailed and balanced explanation of why Jules may have difficulty understanding a sentence in a conversation with a human.

- (d) **The organizers of an important tennis tournament are considering using a robot similar to Jules, named Tennis-Umpire, for the purpose of umpiring some of the games. This robot, which remains seated throughout the match, uses its own cameras to analyse the game and then communicates its decisions to the human spectators using speech.**

Evaluate whether the organizers should go ahead with this decision to replace human umpires with robotic umpires such as Tennis-Umpire. **[10 marks]**

Answers may include:

Positive

- robot would consistently determine the outcome of each play – eliminates variation in human reaction
- robot is not affected by physical conditions (e.g. tiredness, weather, crowd reaction)
- robot is not biased – a human umpire may have a preference towards a particular player winning, or according to recent studies, tennis umpires are more likely to make mistakes when they call balls “out” than when they call them “in”, these errors are a result of the way the human brain processes visual information about motion.

[Source: adapted from <http://physorg.com/news144328896.html>, 4 July 2009]

Negative

- robot may not be able to follow the movement of the ball quickly enough, causing a delay in processing the call
- robots involve mechanical moving parts, there is a possibility of a problem in the physical functioning of the robot (necessitating replacement with another robot or human umpire).
- in a tennis game there are several other officials – one robot cannot call all of the plays (players may block the view, other umpires will be required with the ability to communicate with the Tennis-Umpire)
- robots can judge technical details of tennis (e.g. location of the tennis ball, applying the rules), but cannot judge human aspects of the game (e.g. inappropriate behaviour by players)
- job loss for current umpires
- cost of Tennis-Umpire including hardware, software, updates, maintenance, repairs – this will be offset by saving on salaries
- public (players/supporter) reaction to Tennis-Umpire may be negative – how do players dispute a decision?
- a robot is not programmed to anticipate the unexpected – eg if a supporter interrupts play by running onto the court a human umpire could request a replay.

In part (d) of this question it is expected that there will be a balance in the ITGS terminology between IT technical terminology and the terminology related to the social and ethical impacts.

Please see generic markband information sheet on page 21

Area of impact: Politics and government

6. (a) **Identify *two* IT-based methods of sending text messages simultaneously to a number of people.** [2 marks]

Answers may include:

- *Twitter*
- SMS
- e-mail
- chatroom
- create a group in Facebook, create a text message, send the message to all members in the group.

Award [1 mark] for each method up to a maximum of [2 marks].

- (b) **Describe *two* types of information that would be held in a cookie by *Twitter*.** [4 marks]

Answers may include:

- user ID – you do not have to type it in every time
- password – automatically inputs password
- user preferences – specific settings chosen by the user
- “signed-on” status – whether or not you are logged in or offline
- session tracking – what you have done or where you have been
- IP address – relates login information for a user to an IP address.

N.B. Cookies are used to understand how people visit the site and contain no personal information and are neither shared nor revealed to other sites other than the one that sent the cookie.

Do not award marks if references are made to information being shared or distributed from the user’s hard drive.

Award [1 mark] for identifying each type of information up to a maximum of [2 marks]. Award an additional [1 mark] for the relevant description up to a maximum of [2 marks].

- (c) **Explain how a location determined by cell (mobile) phone technology may be different from that determined by a Global Positioning System (GPS).** *[4 marks]*

Answers may include:

Cell (mobile) phone

- cell (mobile) phone tracking – phone must emit a roaming signal to contact a nearby antenna tower, but does not require an active call
- the technology of locating with a cell (mobile) phone is based on measuring power levels and antenna patterns
- cell (mobile) phones communicate wirelessly with one of the closest base stations, so if you know which base station the phone communicates with, you know that the phone is close to the respective base station
- GSM localization is then done by triangulation to locate the user/cell (mobile) phone on the basis of the strength of the signals.

GPS

- determines precise location
- the distance to the GPS satellites can be determined by estimating the amount of time it takes for their signals to reach the receiver; when the receiver estimates the distance to at least four GPS satellites, it can calculate its position in three dimensions
- uses triangulation to calculate the user's exact location
- a GPS receiver must be locked on to the signal of at least three satellites
- GPS receivers are accurate to approximately 15 metres.

[1 mark]

A limited response that indicates very little understanding of the topic.

[2–3 marks]

A reasonable description of how determining the location differs, although the answer may lack appropriate reasoning at the lower end of the band.

[4 marks]

A clear, detailed explanation (with reasons) of the way the two methods of determining locations differ.

- (d) Under certain circumstances, government authorities require organizations, such as *Twitter*, to provide them with information about individuals and data that has been collected from individuals' online activities. To what extent is this acceptable? *[10 marks]*

Answers may include:

- government authorities are required to have a search warrant/court orders/subpoenas
- data requested by government authorities is a matter of national security
- law enforcement agencies request information to identify or locate a suspect/fugitive/witness/missing person
- a crime has been committed and the data is relevant
- government authorities meet legal obligations to specify the purposes for which personal information is used
- government authorities collect and process appropriate personal information only to the extent that it is needed to fulfil operational needs or to comply with any legal requirements
- organizations ensure that the rights of people about whom information is held can be fully exercised under a country's data protection act
- organizations have taken appropriate technical and organizational security measures to safeguard personal information from unauthorized access
- organizations and government authorities ensure that personal information is not being transferred to third-party companies
- organizations have clearly stated the conditions in their online policy statements, under which they will provide information to government agencies.

In part (d) of this question it is acceptable if there is more emphasis on the ITGS terminology related to social and ethical impacts and less on IT technical terminology.

Please see generic markband information sheet on page 21